11/28/16

"Remember no one can make you feel inferior without your consent."-Eleanor Roosevelt

HW: "Implicit Differentiation" w/s #1-6

Test 1 on Thursday 12/1

AIM: How do we do Implicit Differentiation?

Warm-up:

Find $\frac{dy}{dx}$ for each of the following:

1) $y = 3x+5$

$\frac{dy}{dx} = 3$

2) $xy=5$

$y = \frac{5}{x} = 5x^{-1}$

$\frac{dy}{dx} = -5x^{-2}$

$\frac{dy}{dx} = \frac{-5}{x^2}$

For these, y is a function explicitly defined in terms of x.

$y=3x^2+2x$

$y=x+1$

$y=\sin x$

$y=\sqrt{x^2+2}$

For these, y is a function implicitly defined in terms of x.

$xy=12$

$3x^2y+2y^2-5=0$

$x+xy+y=5$

$y=\cos(xy)$

Be able to explain what makes a function implicitly defined vs. explicitly defined.

y is mixed in with "x"s

Y is by itself

$\frac{dy}{dx}$ = "Derivative of y with respect to x".

Implicit Differentiation

$\frac{d}{dx}[x^3+2x]$

ex. $\frac{d}{dx}[y] = \frac{dy}{dx}$

ex. $\frac{d}{dx}[2y] = 2\cdot\frac{dy}{dx}$

Think:

$f(x) = 2x$

$f'(x) = 2$

ex. $\frac{d}{dx}[y^2] = 2y\cdot\frac{dy}{dx}$

Implicit Differentiation

Take the derivative of each term with respect to x and solve for dy/dx.

get $\frac{dy}{dx}$ by itself

ex. Find dy/dx for $y^2+3x=x^2$

$2(y)\cdot\frac{dy}{dx}+3=2x$

$-3 \quad -3$

$\frac{2y\cdot\frac{dy}{dx}}{2y}=\frac{2x-3}{2y}$

$\frac{dy}{dx}=\frac{2x-3}{2y}$

ex. Find dy/dx for sinx+cosy=2y

$$\cos(x) - \sin(y)\cdot\frac{dy}{dx} = 2\frac{dy}{dx}$$

$$+\sin(y)\frac{dy}{dx} \qquad +\sin(y)\frac{dy}{dx}$$

$$\cos(x) = 2\cdot\frac{dy}{dx} + \sin(y)\cdot\frac{dy}{dx}$$

$$\frac{\cos(x)}{2+\sin(y)} = \frac{\frac{dy}{dx}(2+\sin(y))}{2+\sin(y)}$$

$$\boxed{\frac{dy}{dx} = \frac{\cos(x)}{2+\sin(y)}}$$

ex. Find dy/dx for $y^2+xy+x^2=5$ (product rule)

$$2y\cdot\frac{dy}{dx} + \boxed{x\cdot\frac{dy}{dx} + 1y} + 2x = 0$$

$$-1y \quad -2x \quad -1y-2x$$

$$2y\cdot\frac{dy}{dx} + x\frac{dy}{dx} = -1y-2x$$

$$\frac{\frac{dy}{dx}(2y+x)}{2y+x} = \frac{-1y-2x}{2y+x}$$

$$\boxed{\frac{dy}{dx} = \frac{-1y+2x}{2y+x}}$$

ex. $x^2 - xy + y^2 = 3$

a. Show that $\frac{dy}{dx} = \frac{y - 2x}{2y - x}$

b. Find any point(s) where the tangent line is horizontal.